COMPUTER MODELS FOR PREDICTING FLYWHEEL SYSTEM FAILURE MODES AND ROTOR CRASH LOADS

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DOE PROGRAM

OBJECTIVE:

Develop safety and containment technology and analytical capabilities which will enable industry to design and build flywheel systems for automotive use

APPROACH:

- Formulate safety and containment models
  - review failure load information
  - identify underlying physics
  - engineering calculations
  - computer codes
- Establish design strategies and tools
  - safety analysis
  - rotor design methodology
  - containment design methodology
- Develop enabling technologies
  - bearings
  - materials for rotor and containment
  - instrumentation
  - power electronics
- Establish standardized test procedures
  - operability and performance
  - environmental insults
  - demonstrate containment adequacy

FLYWHEEL SYSTEM SAFETY DESIGN STRATEGY

AVOID FAILURE

- Conduct safety analyses (FTAs, FMEAs and ETAs)

- Determine critical lifetimes (cycle life, stress life, creep life)

- Apply wide critical lifetime or operating design margins such as
  - operate at low ratio of stress to ultimate stress;
  - select operating speed for infinite cycle life
  - select materials with acceptable creep characteristics

- Monitor rotor condition using changes in runout, vibration, temperature, and vacuum level to detect problems

MINIMIZE FAILURE LOADS

- Build in a fuse link that induces a benign failure

- Use a rapid dump energy system

MINIMIZE FAILURE EFFECTS

- Develop containment that can manage pressure and penetration loads